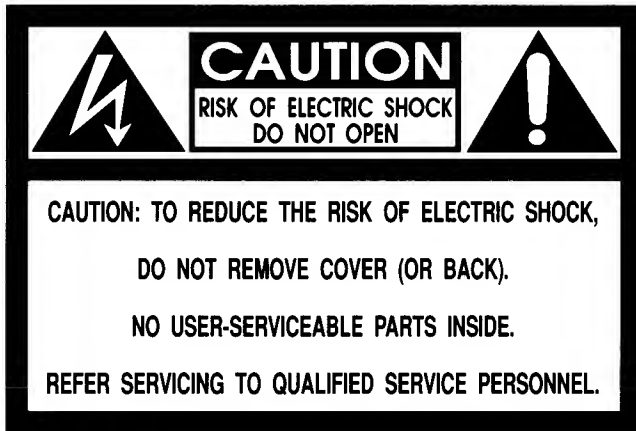




**MODEL 422A**  
**USER MANUAL**

# Important Safeguards



## WARNING

To prevent fire or shock hazard, do not expose the unit to rain or moisture.

**ATTENTION: RISQUE DE CHOC ELECTRIC- NE PAS OUVRIIR.**



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point, within a equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

**For your protection, please read these safety instructions completely before operating the appliance, and keep this manual for future reference.**

**Carefully observe all warnings, precautions and instructions on the appliance and described in the operating instructions supplied with the appliance.**

## INSTALLATION

**Water and Moisture** - Do not install the appliance near water; for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool.

**Heat** - Do not install the appliance near sources of heat such as radiators, heat registers, stoves, or other appliances that produce heat.

**Ventilation** - Situate the product so its location or position does not interfere with its proper ventilation. For example, you should not place the product on a bed, sofa, rug, or similar surface that might block the vent openings, or placed in a built-in installation, such as a bookcase or cabinet that might impede the flow of air through the ventilation openings.

**Wall or Ceiling Mounting** - If your appliance can be mounted to a wall or ceiling, mount it only as recommended.

## USE

**Power Source** - Connect the appliance to a power supply only of the type described in the operating instructions or as marked on the appliance.

**Grounding or Polarization** - Do not defeat the grounding or polarization feature of the AC power cord. If your AC receptacle will not accept the power cord plug, contact your electrician to install a proper AC receptacle.

**AC Receptacle** - Check to make sure that the AC receptacle holds the power cord plug firmly and securely. If the power cord plug is loose, contact your electrician to replace the defective and unsafe AC

**Power-Cord Protection** - Route the power cord so that it is not likely to be walked on or pinched by having objects placed on it, paying particular attention to the plugs, receptacles, and the point where the cord exits from the appliance.

**When not in use** - Unplug the power cord of the appliance from the outlet when left unused for a long period of time. To disconnect the cord, pull it out by grasping the plug. Never pull the plug out by the cord.

**Foreign Objects** - Be careful that foreign objects and liquids do not enter the enclosure through openings.

## SERVICE

Unplug the appliance from the wall outlet and consult qualified service personnel when:

- the power cord or the plug has been damaged.
- a solid object or liquid has fallen into the cabinet.

- the appliance has been exposed to rain or moisture.
- the appliance does not appear to operate normally or exhibits a marked change in performance.
- the appliance has been dropped, or the enclosure damaged.

Do not attempt to service the appliance beyond that described in the operating instructions. For all other servicing, refer to qualified service personnel **only**.

## **Congratulations!**

Thank you for buying the BBE 422A Sonic Maximizer. You now own a very unique signal processing device with no other equal in the audio world. Whether you purchased the BBE 422A for your home studio or club P.A. system, you will find the unit's rugged construction and careful electronic design a welcome addition to your audio system.

This manual will help you use the BBE more effectively and in ways of which you may not be aware. Review of the information contained in this manual will answer most of the common questions that our service department receives. But if you still have questions, please feel free to call (714) 897-6766.

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## **The BBE® Process—"What Is It"**

Loudspeakers have difficulty dealing with the electronic signals supplied by an amplifier. These difficulties cause such major phase and amplitude distortion that the sound reproduced by a speaker differs significantly from the sound produced by the original source.

In the past, these problems proved unsolvable and were thus delegated to a position of secondary importance in audio system design. However, phase and amplitude integrity is essential to accurate sound reproduction. Research shows that the information which the listener translates into the recognizable characteristics of a live performance are intimately tied into complex time and amplitude relationships between the fundamental and harmonic components of a given musical note or sound. These relationships define a sound's "sound".

When these complex relationships pass through a speaker, the proper order is lost. The higher frequencies are delayed. A lower order frequency may reach the listener's ear first or perhaps simultaneously with that of a higher frequency. In some cases, the fundamental components may be so time-shifted that they reach the listener's ear ahead of some or all of the harmonic components.

This change in the phase and amplitude relationship on the harmonic and fundamental frequencies is technically called "envelope distortion." The listener perceives this loss of sound integrity in the reproduced sound as "muddy" and "smeared." In the extreme, it can become difficult to tell the difference among musical instruments, for example, an oboe and a clarinet.

BBE Sound, Inc. conducted extensive studies of numerous speaker systems over a ten year period. With this knowledge it became possible to develop an ideal speaker and to distill the corrections necessary to return the fundamental and harmonic frequency structures to their correct order. While there are differences among various speaker designs in the magnitude of their needs for correction, the overall pattern of correction needed is remarkably consistent.

The BBE® process is so unique that 42 patents have been awarded by the U.S. Patent Office.

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## **"How It Works"**

The BBE® process imparts a pre-determined phase correction to the high frequencies where most harmonic information exists. This is done by breaking the signal into three sub-bands or groups: the low frequency group which is crossed over at 150Hz, the mid-range group which is crossed over at 1200Hz and the high frequency group that handles everything else up to 20kHz.

The low group is delayed about 2.5 ms (milliseconds) via a group delay within a passive low pass filter. The front panel control allows for either a flat response, a cut or a boost of the lows at 50Hz.

The mid-range group is delayed only about 0.5ms and passes through an active band-pass filter while the high frequency group is passed through a high quality VCA (Voltage Controlled Amplifier). The high group is used as a point of reference to make dynamic amplitude corrections in both positive and negative directions to the high frequencies.

Two RMS average loudness detectors continuously monitor both the mid-range and high frequencies to compare the relative harmonic content levels of the two bands and apply the appropriate amount of control voltage to the VCA, thereby determining the amount of high frequency harmonic content present at the final output of the BBE® processor.

## **Product Description**

The BBE 422A is an intelligent audio processor designed to solve a series of complex problems as described in the previous section. It is, however, very simple to set-up and operate and once installed will function flawlessly without further attention.

It is a dual channel, rack-mountable device for use in -10dBu unbalanced line level applications such as those found in semi-professional and musical instrument applications. The BBE 422A takes up one EIA standard rack space of 19 inches width and 1.75 inches height (1U). There are two separate channels to allow for either full stereo program or two independent mono channels: A house P.A. mix feed for one channel and the stage monitor feed for the other channel.

BBE® applies different phase correction algorithms to three separate frequency bands. The variable front panel control allows the user to adjust the amount of process desired.

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## **Using Your New BBE 422A**

BBE® is a process to be added before all other mixing of reverb, special effects or equalization in order to increase the clarity and intelligibility of the program material.

Unlike many aural exciters or equalizers, the BBE 422A does not add any extra noise or harmonics to the sound. Thus, there will be no future problems in duplication or mastering caused by aberrant high frequency distortion. Since the BBE® technology is a single-stage process there is no need for encoding or decoding.

Always "A-B" the processed to unprocessed sound with the Process In/Out Switch to adjust the amount of processing required to suit your own musical tastes.

---

## **Things To Remember**

The BBE 422A is designed to work in -10dBu levels. This is suitable for most semi-pro mixers, P.A. consoles, home stereos or disco equipment. The BBE 422A drives load impedances down to about 1K Ohms and supplies a maximum level of +16dBu. Plugging a guitar or a microphone directly into the BBE 422A will not work, as the output level is much too low. In this application, a BBE 411 can be used as it accepts low level devices.

If the program material has excessive background noise, the noise may be modulated with the program. In this case, an equalizer or some type of noise reduction system should be inserted in front of the BBE 422A to roll off the noise first.

### **WARNING!**

It is good practice to turn on any effects boxes such as BBE, equalizers, expanders, surround sound accessories, etc., and the preamp BEFORE turning on the power amplifier. Otherwise damage to the speakers and/or amplifier may result.

## The Controls

Operation of the BBE 422A is quite simple due to the sophisticated circuitry within the unit. Below are the names and purposes of each control on the BBE 422A.

### Front Panel

<b>Lo Contour Control</b>	Each channel has a lo contour control that regulates the amount of phase compensated bass equalization. This adjustment ranges from -12dBu (fully counterclockwise) to +10dBu (fully clockwise) at 50Hz relative to the input. The middle position is flat or unity gain.
<b>Definition Control</b>	Each channel has a definition control that regulates the amount of amplitude compensation as indicated by the hi contour LED stack. The minimum (fully counterclockwise) position yields a flat frequency response with phase compensation only. Turning clockwise increases the amplitude of the high frequency band relative to the mid band amplitude providing an improved spectral balance between the high and mid bands.
<b>Hi Contour LED Stack</b>	<p>Each channel is equipped with a set of LED indicators that instantly show the relative amount of high band compensation compared to the mid band.</p> <p>1) RED LED (marked "—"): Compression mode. The amplitude of the high band is too high compared to the mid band and compression is being applied to compensate.</p> <p>2) AMBER LED (marked "O"): Flat mode. No amplitude compensation is needed. The program spectral content is correct.</p> <p>3) GREEN LED (marked "+"): Expansion mode. The amplitude of the high band is too low compared to the mid band and the amplitude of the high band is being expanded to compensate.</p> <p>4) CLIP LED: This LED indicates that the input of the BBE 422A has reached the maximum input level of + 16dBu.</p>
<b>Function Switch</b>	The unit is equipped with a function push-button switch which allows for a quick comparison of processed with unprocessed sound. When the switch is depressed, the green "In" LED lights. When the switch is out, the amber "Out" LED lights.
<b>Process Switch</b>	<p>In the "Auto" mode, the BBE422A provides dynamic response to the high frequency band in relation to the mid band. This in turn will allow the BBE process to either expand or compress the high band.</p> <p>The "Manual" mode, on the other hand, provides for a factory preset expansion ratio for the high band. Both modes are controlled by the definition and lo-contour controls. "Auto" mode would be considered normal operation.</p>
<b>Power Switch</b>	This switch controls primary power to the BBE 422A.

### Rear Panel

<b>AC Power Cord</b>	Plugs into AC power receptacle. U.S. Model, 100-120Vac, 50/60Hz. Standard Model, 200-240Vac, 50/60Hz.
<b>Fuse</b>	Turn cap on fuse holder counterclockwise to remove fuse. (Note: For U.S. Model, replace with 250VAC, ½A Fastblow type fuse. For Standard Model, replace with 250Vac, .125A Fastblow type fuse.)
<b>Remote Jack</b>	An additional ¼" jack is provided for remote actuation of the function switch. Any push-on/push-off single pole switch will work as a remote. The front panel function switch will become inoperative when the remote jack is utilized.
<b>HI-Z Unbalanced ¼" or RCA Output</b>	Each channel is equipped with a ¼" phone jack and an RCA jack that is a high impedance unbalanced line level output and can deliver up to +16dBu into 10k Ohms.
<b>HI-Z Unbalanced ¼" or RCA Input</b>	Each channel is equipped with a ¼" phone jack and an RCA jack that accepts a high impedance unbalanced line level input with an average level of -10dBu. (Note: +16dBu is the maximum input before clipping.)

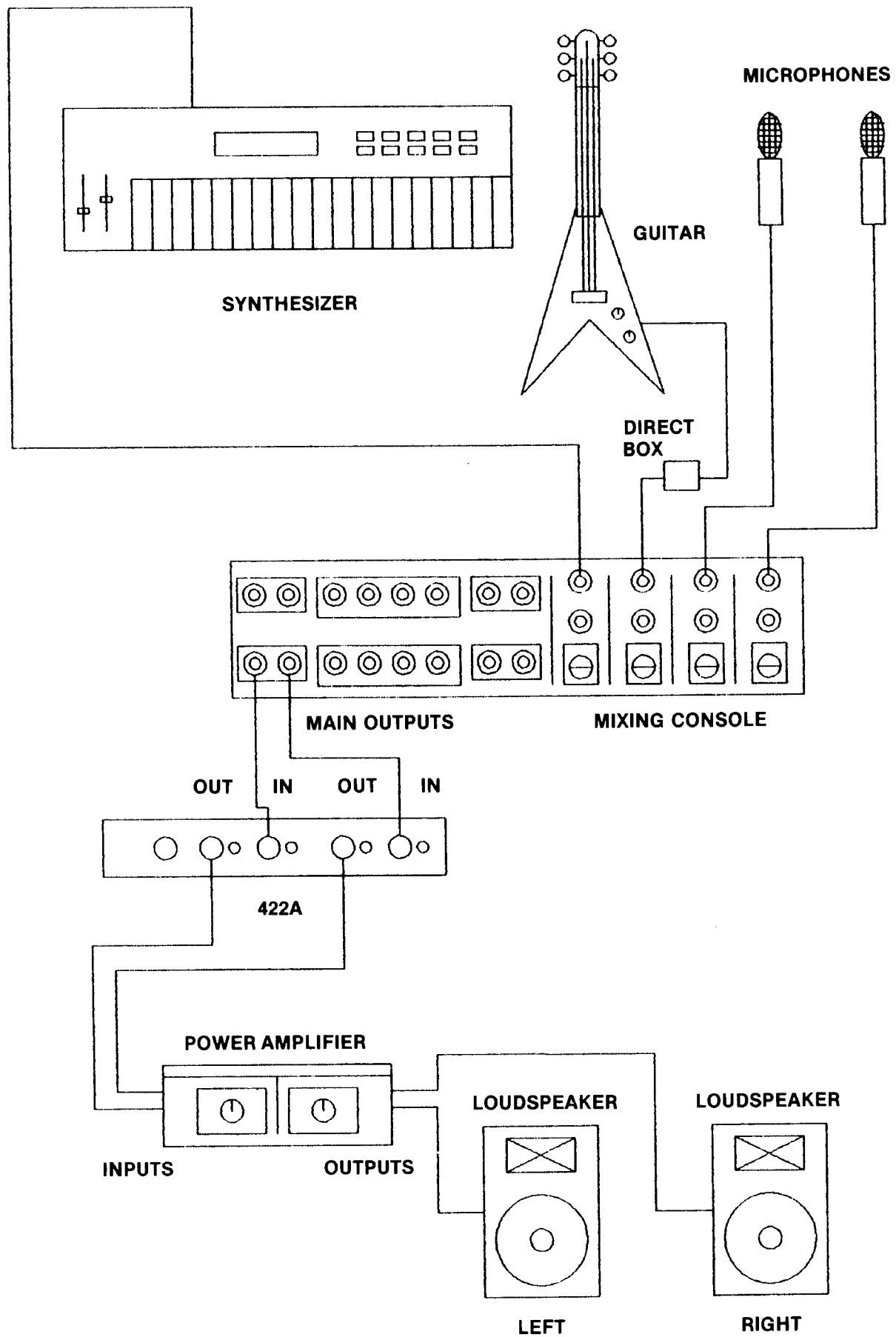
## Set-Up

The BBE 422A is connected into the audio chain in **series** with the signal path—the same way a graphic equalizer or limiter is connected. The output of the mixer, pre-amp or tape recorder feeds the input of the BBE 422A. Remember, source outputs connect to the BBE's inputs and as long as the signal source level is within the nominal range as mentioned in the previous section, the BBE 422A will function perfectly.

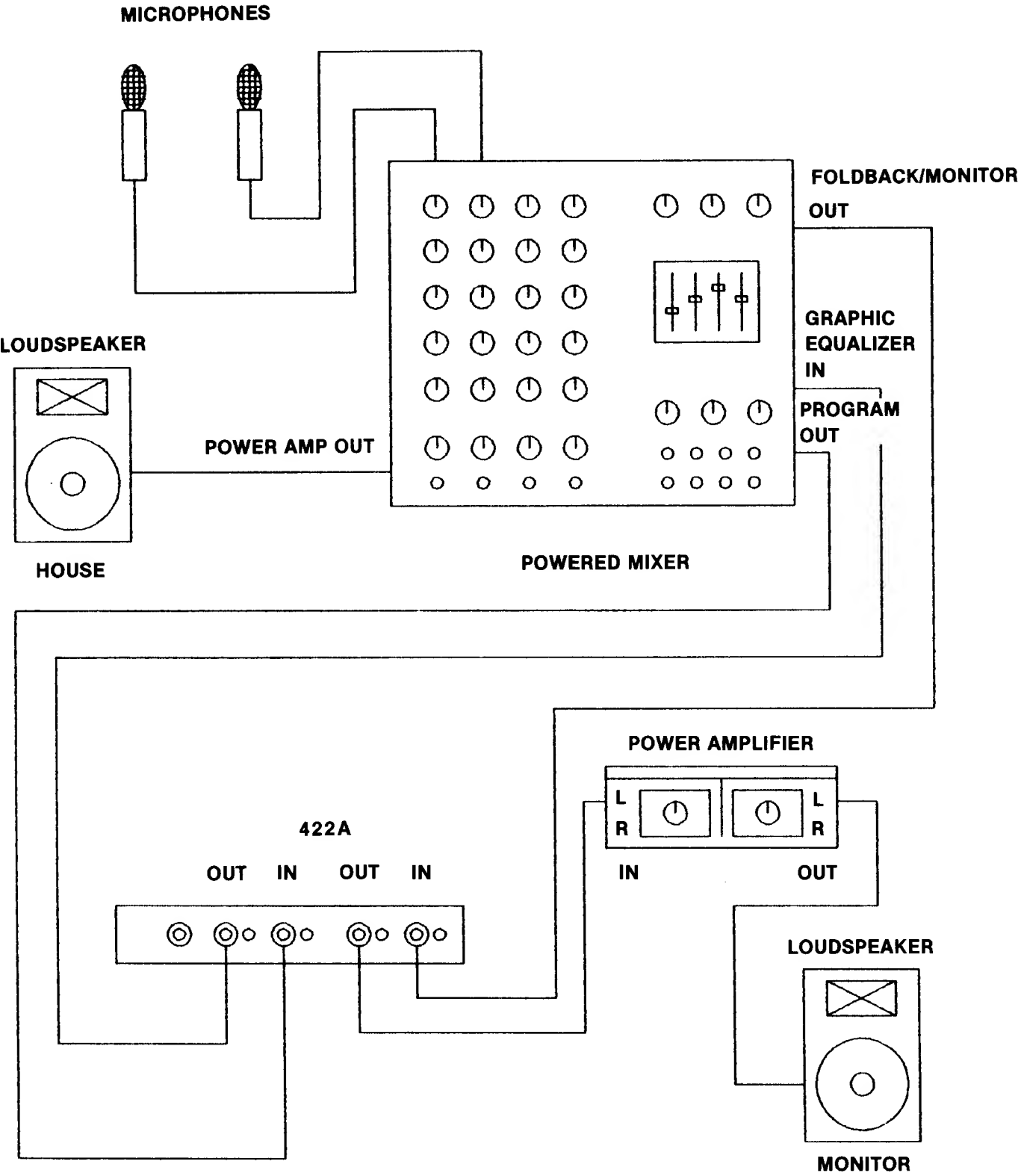
Setting-up and using the BBE 422A as an echo send device like a digital reverb is **not** recommended. The processing effect is not fully realized when the output of the BBE 422A is summed with the original source audio.

The BBE 422A also has an additional quarter inch jack for remote actuation of the process in/out switch. Any single-pole, single-throw switch, such as a footswitch, will work.

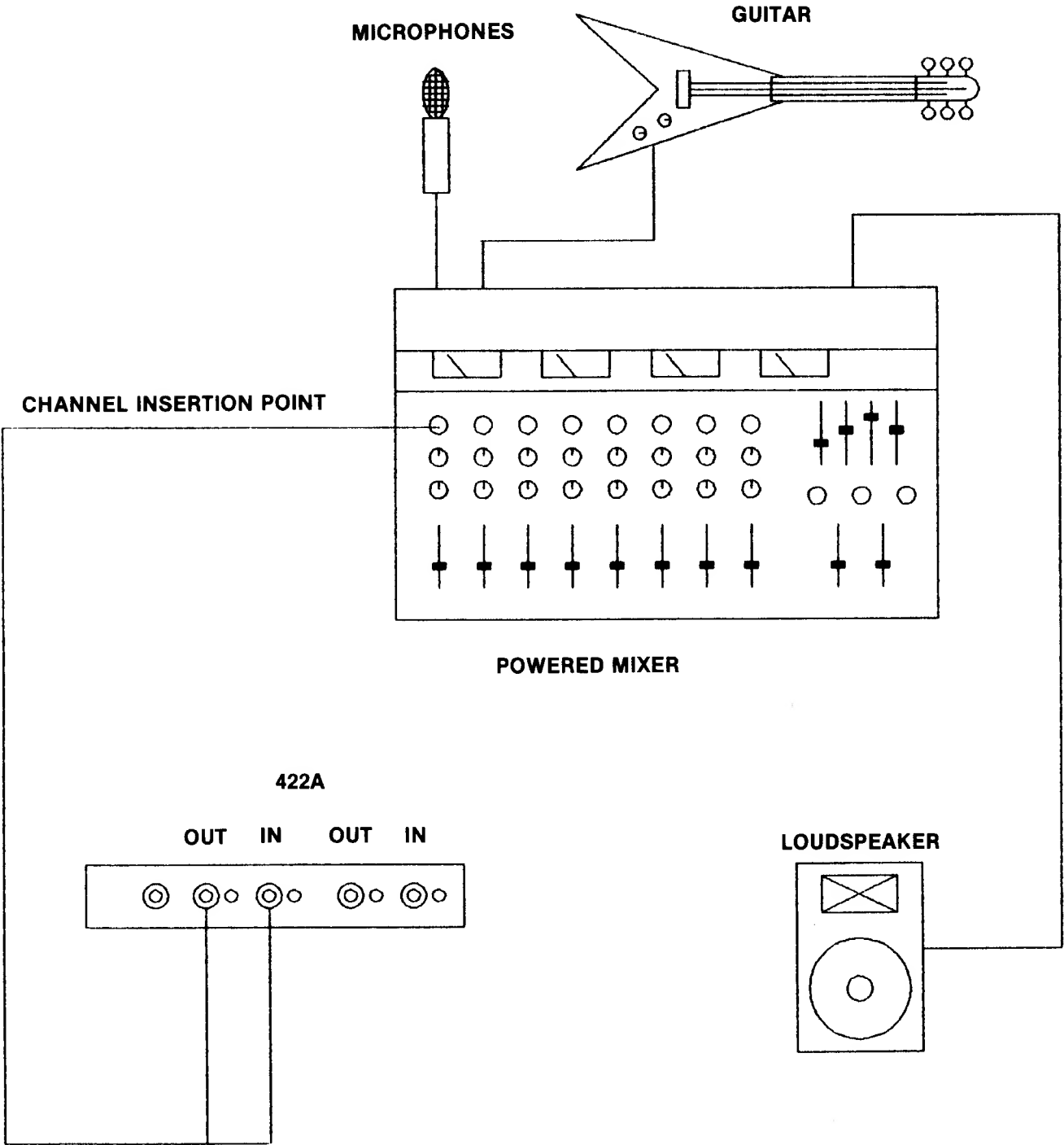
**FIGURE 1**  
**LIVE SOUND SYSTEM**



**FIGURE 1A**  
**POWERED MIXER SYSTEM APPLICATION**

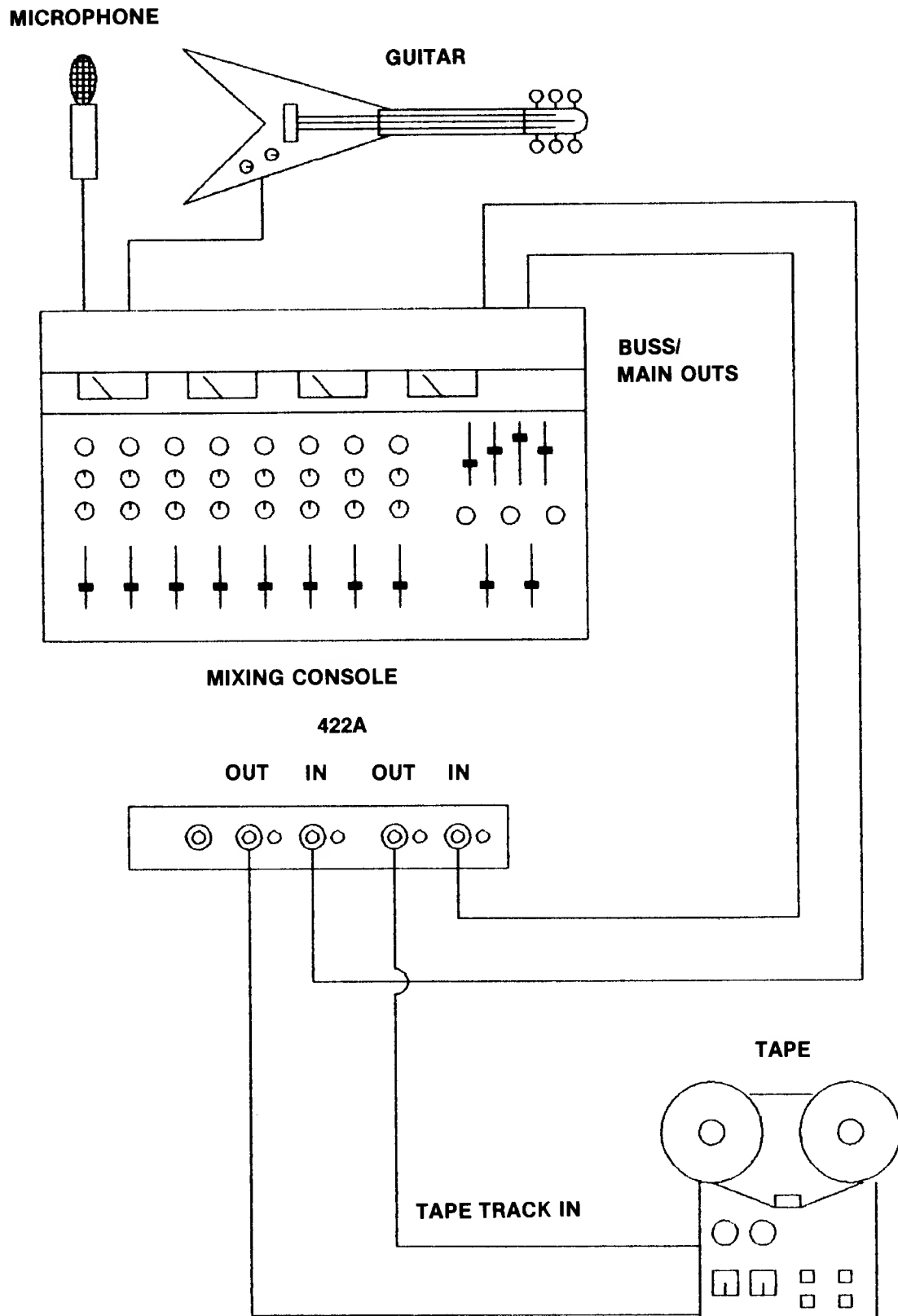


**FIGURE 1B**  
**POWERED MIXER SYSTEM APPLICATION**

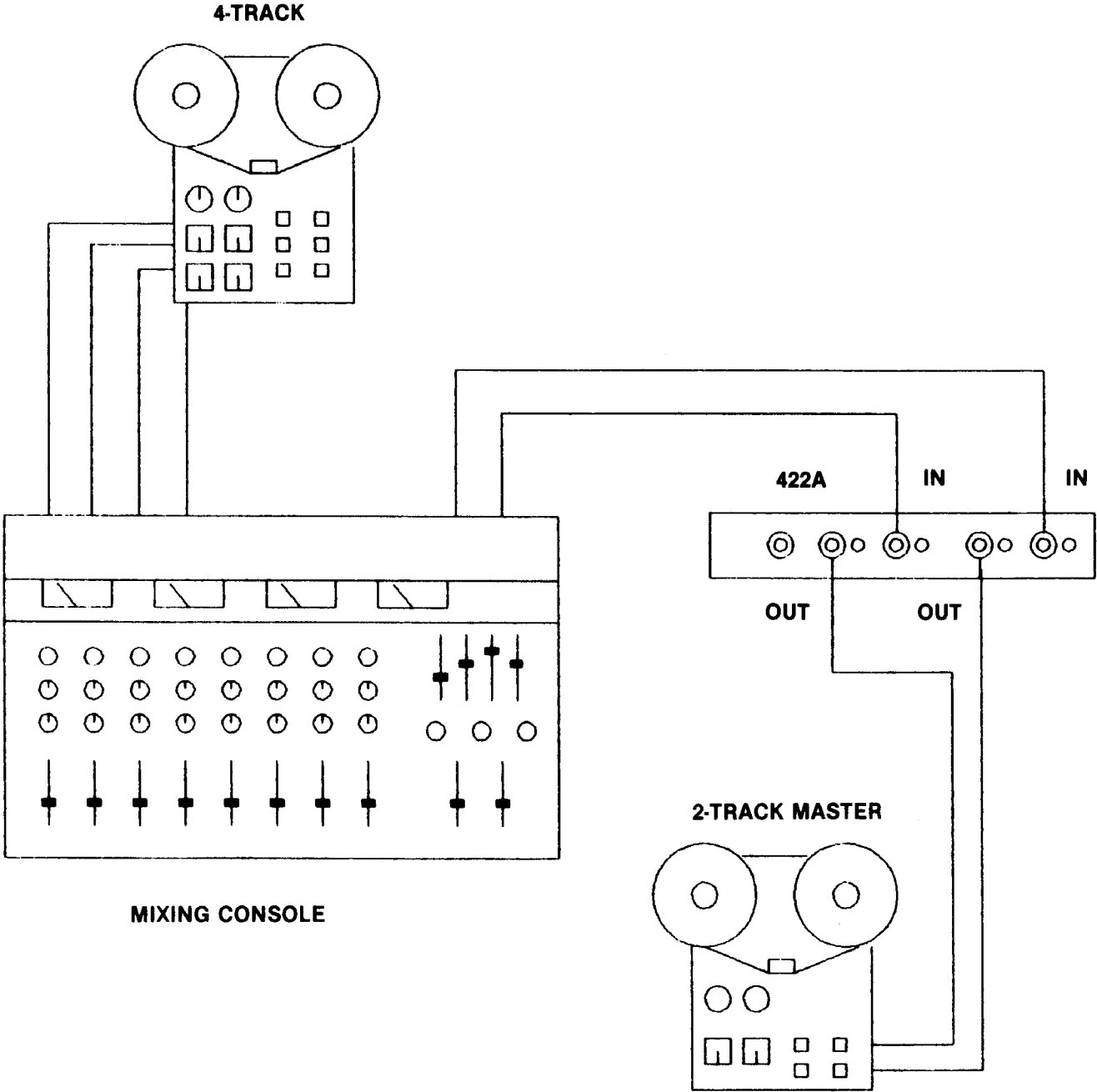




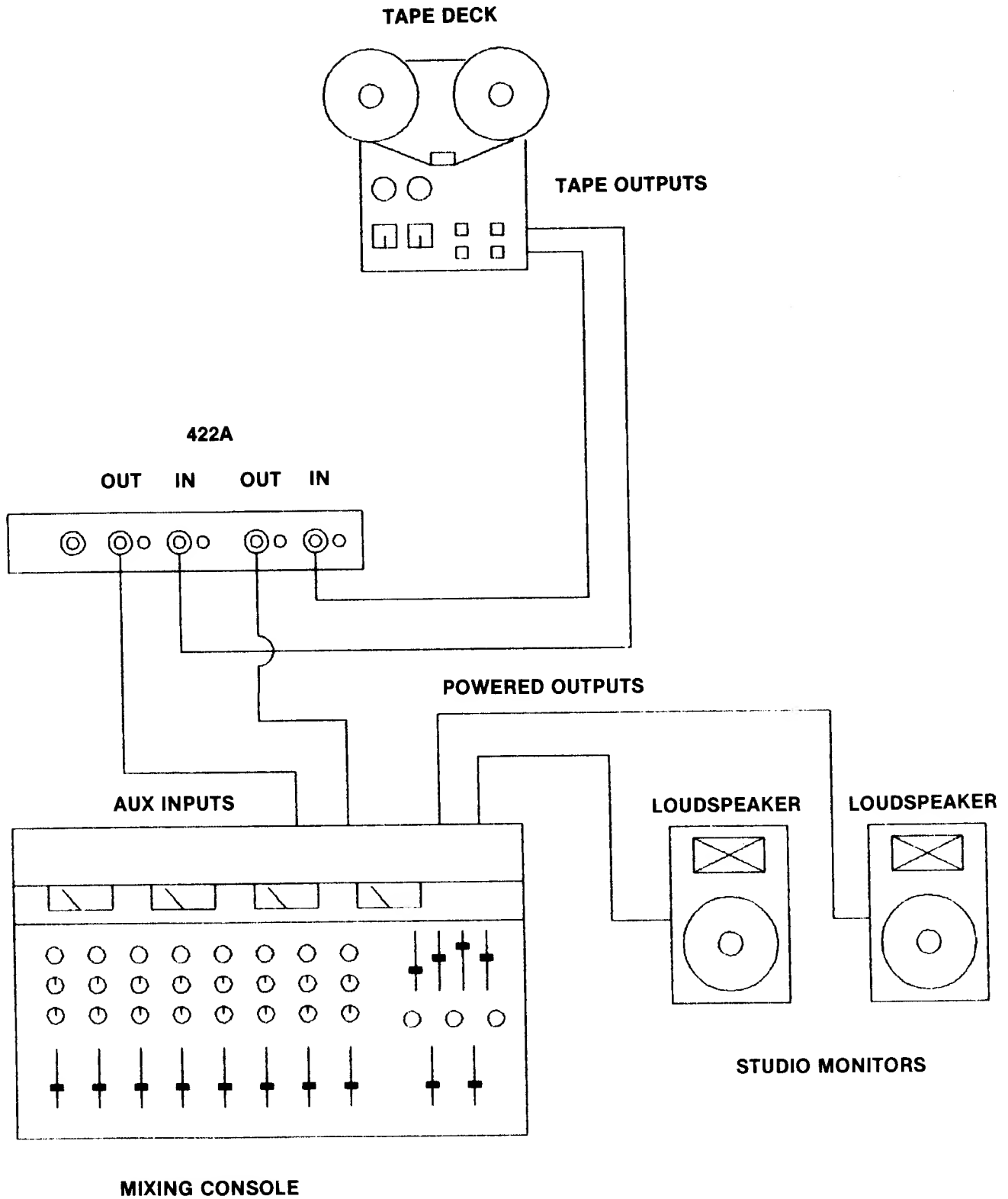
**FIGURE 2**  
**RECORDING**  
**HOME STUDIO APPLICATION**



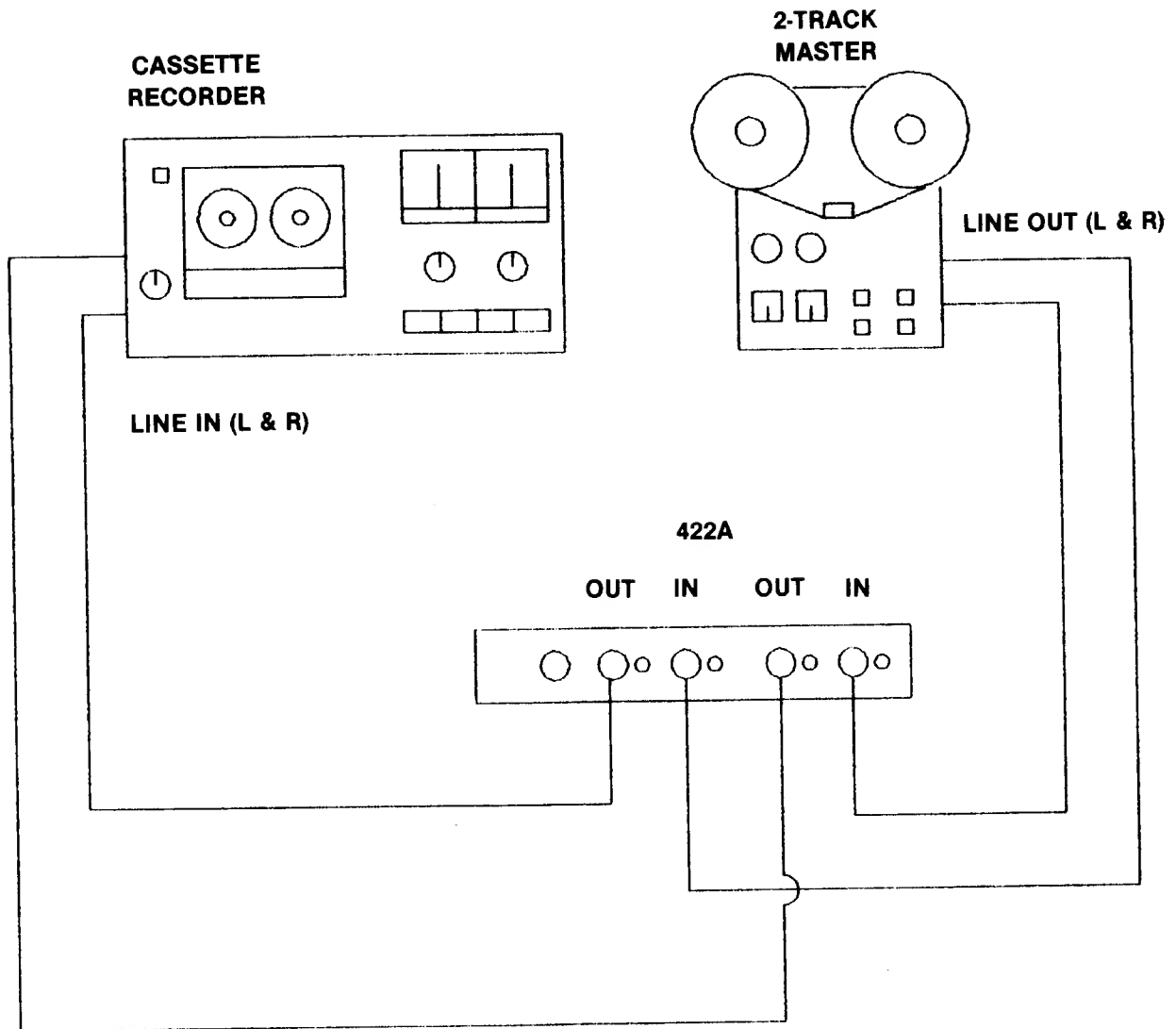
**FIGURE 2A**  
**RECORDING MIX DOWN**



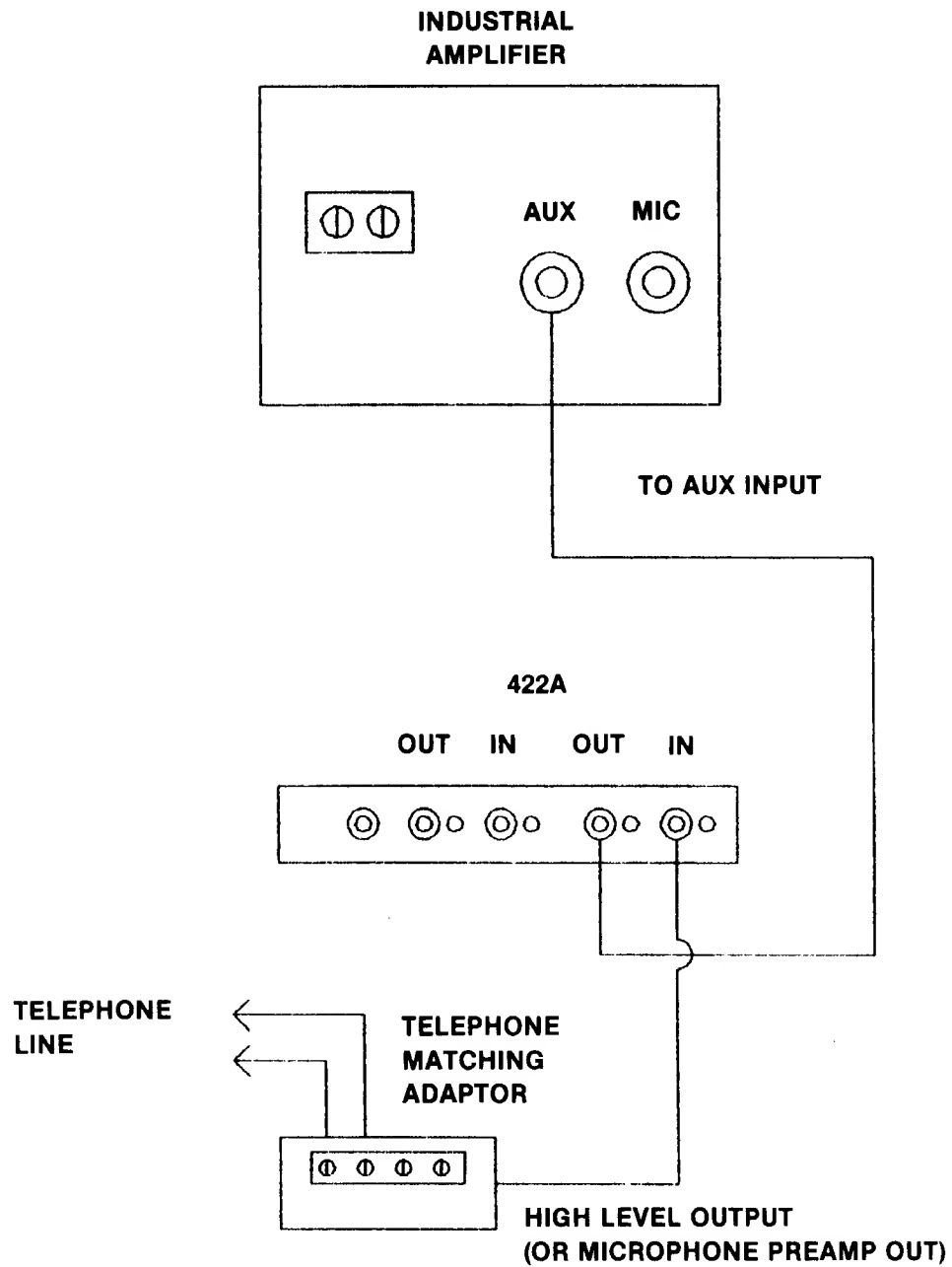
**FIGURE 2B**  
**PLAYBACK**  
**HOME STUDIO APPLICATION**



**FIGURE 3**  
**CASSETTE COPIES**



**FIGURE 4**  
**INDUSTRIAL PAGING SYSTEM**



## Specifications BBE 422A

Frequency Response		Power Requirements	
Bypass	DC to 20kHz	U.S. Model	100-120Vac, 50/60Hz, 10 Watts
Process Mode	program controlled	Standard Model	200-240Vac, 50/60Hz, 10 Watts
Absolute Noise in Process Mode	- 87dBu below rated max output of 0dBu	AC Line fuse protected	U.S. Model, 250Vac, 1/2A Fastblow type fuse
Total Harmonic Distortion in Process Mode	less than 0.1% @ - 10dBu Level		Standard Model, 250Vac, .125A Fastblow type fuse
Input Characteristics		Terminations/Connectors	
Input Impedance	50K Ohms	Rear Panel	RCA Jacks and 1/4" Phone Jacks
Nominal Input Level	- 10dBu		
Maximum Input Level	+ 16dBu	Dimensions	
		1 3/4" H x 19" W x 5 3/4" D	Standard 1U single rack
Output Characteristics		Weight	
Minimum Load Impedance		4 1/2 lbs. (2.5Kgs)	
for full output level	1K Ohm		
Nominal Output Level	- 10dBu	NOTE: 0dBu = 0.775 Vrms	
Maximum Output Level	+ 16dBu		

## Service

We recommend that if at all possible a BBE 422A which requires service be sent to our facility in Huntington Beach, CA. We request that a "RETURN AUTHORIZATION" be issued by the dealer from whom you purchased the unit. If this is not possible, call BBE Sound, Inc. directly at (714) 897-6766, to obtain a 'RETURN AUTHORIZATION'. Include a copy of the bill of sale with the unit when it is shipped to BBE Sound, Inc. so that the service can be expedited.

As the repair turnaround time is minimal, we request that the unit be sent to BBE Sound, Inc. We also need to add reliability data to our files so that future revisions may be undertaken, if necessary, to improve the product.

## Warranty

Warranty registration of the unit to BBE Sound, Inc. is not necessary. It is strongly recommended that you retain a copy of the bill of sale for future reference.

**IT IS THE SOLE RESPONSIBILITY OF THE END USER TO PROVIDE THE BILL OF SALE OR OTHER MEANS OF PROOF OF PURCHASE TO VALIDATE THE WARRANTY IF WARRANTY SERVICE IS REQUESTED.**

The BBE 422A is warranted against defects in material and workmanship for a period of one (1) year from date of purchase from BBE Sound, Inc. or from an authorized dealer.

During this period, we will repair units free of charge providing that they are shipped prepaid to BBE Sound, Inc., 5500 Bolsa Ave., Suite 245, Huntington Beach, CA 92649. We will pay return UPS shipping charges within the USA. All charges related to non-UPS shipping, including customs clearance, will be billed. The warranty will be honored for the longer of either 90 days from the date of any service or the remainder of the original 1 Year factory warranty.

This warranty will be considered null and void by BBE Sound, Inc. if any of the following is found:

1. The equipment has been physically damaged.
2. The equipment shows signs of abuse.
3. The equipment has been electrically damaged by improper connection or attempted repair by the customer or a third party.
4. The equipment has been modified without authorization.
5. The bill of sale indicates that the purchase date of the equipment is not within the warranty period.

All non-warranty repairs are warranted for a period of 90 days from the date of service.

BBE Sound, Inc. is NOT LIABLE FOR CONSEQUENTIAL DAMAGES. Should the unit fail to operate for any reason, our sole obligation is to repair it as described above.

**DO NOT RETURN ANY PRODUCT TO THE ABOVE ADDRESS WITHOUT INSTRUCTIONS AND AUTHORIZATION ISSUED BY THE ABOVE LOCATION.**

## Maintenance

Maintenance of the BBE 422A is limited to proper cleaning of the unit with mild household cleaner such as Formula 409™ or Windex™. The chassis and cover are steel finished with a durable polyurethane paint, while the front panel is an anodized aluminum extrusion.

There are no user replaceable parts and the unit should not be opened for any reason unless you are a qualified technician.

Calibration should be performed if parts are replaced or if a performance check-out indicates a problem with calibration. Long term use has shown that over the life of this unit there is little or no drift of the components in the BBE 422A which would cause a change in calibration. A very conservative design philosophy has resulted in a piece of equipment which runs very cool and should give years of trouble-free service.

## CALIBRATION PROCEDURE FOR THE BBE® MODEL 422A

NOTE: THIS UNIT WAS CALIBRATED AT THE FACTORY. THIS PROCEDURE IS FOR QUALIFIED SERVICE PERSONNEL ONLY.

Revision Q-50-3, August 7, 1990

### Equipment Required:

Audio Signal Generator (sine wave)

Digital Voltmeter (DVM)

This procedure details the calibration of channel A. Comments [in brackets] pertain to channel B. All tests are done with a signal level of -10dBu (.245Vrms) except for the clip indicator check. The signal will be input into the 1/4" connector marked INPUT. The DVM shall monitor the 1/4" connector of each corresponding channel marked OUTPUT.

### Initial Settings

- 1) DEFINITION controls VR2 [VR6] to minimum.
- 2) Turn VR1 [VR5], VR4 [VR8] and VR3 [VR7] to their middle positions.
- 3) POWER switch ON and FUNCTION switch IN (process on).
- 4) PROCESS switch to AUTO.

### PROCEDURE:

#### Offset Adjustment:

- 1) Unit should be on and the regulators should be warm to the touch.
- 2) With no signal present at the input (open) measure TP1 [TP2] with the DVM set to DC volts.
- 3) Adjust VR1 [VR5] until DVM reads 0.00VDC.

#### Power Supply Test:

- 1) With DVM set to DC volts measure the positive end of C51. It should be less than +30VDC.
- 2) With DVM set to DC volts measure the negative end of C52. It should be less than -30VDC.
- 3) With DVM set to DC volts measure pin-4 of U2. You should read +15VDC (+/- 0.5VDC).
- 4) With DVM set to DC volts measure pin-11 of U2. You should read -15VDC (+/- 0.5VDC).

#### Unity Adjustment: (Note: VR2 [VR6] to minimum)

- 1) Input a 5000Hz signal (@ -10dBu) into the connector marked CHANNEL A [B] INPUT.
- 2) Measure the connector marked OUTPUT CHANNEL A [B] with the DVM
- 3) Adjust VR4 [VR8] until the DVM reads -13.5 dBu.
- 4) Set generator to 500Hz (@ -10dBu).
- 5) The DVM should read -10.5 (+/-0.5dBu).

#### Lo-Contour Test:

- 1) Input a 50Hz signal (@ -10dBu) into the connector marked CHANNEL A [B] INPUT.
- 2) Measure the connector marked OUTPUT CHANNEL A [B] with the DVM set to AC volts.
- 3) Turn the LO-CONTOUR control completely clockwise (marked "+"). The DVM should read 0dBu (+/- 1.0dBu)
- 4) Turn the LO-CONTOUR control completely counter-clockwise (marked "-"). The DVM should read -22dBu (+/-1.0dBu)
- 5) Turn the control to the middle position (marked "0"). The DVM should read approximately -8.5dBu (+/- 1.0dBu).

#### Detector Check:

(Note: The DEFINITION control must be completely minimum)

- 1) Input a 500Hz signal @ -10dBu into the connector marked CHANNEL A [B] INPUT.
- 2) With DVM measure TP1 [TP2] you should read +0.380VDC (+/- 0.040VDC)
- 3) Change source to 5000Hz (@ -10dBu). With the DVM, measure TP1 [TP2], you should read +0.440VDC (+/- 0.040VDC)

#### Manual Process Switch Test:

- 1) Input 5000Hz signal @ -10dBu into the connector marked CHANNEL A [B] INPUT.
- 2) Measure the connector marked OUTPUT CHANNEL A [B] with the DVM set to AC volts.
- 3) Turn the DEFINITION control to maximum and the DVM should read -1.0dBu (+/- 0.5dBu).
- 4) Switch the PROCESS switch to MANUAL.
- 5) With the DEFINITION control to MAXIMUM with the DVM measure TP1[TP2]. The DVM should read +0.340VDC (+/- 0.030VDC)
- 6) Return the DEFINITION control to MINIMUM.

#### Bypass Test:

- 1) Switch the FUNCTION switch OUT (bypass mode).
- 2) Input a 500Hz signal (@ -10dBu) into the connector marked CHANNEL A [B] INPUT.
- 3) Measure the connector marked OUTPUT CHANNEL A [B] with the DVM set to AC volts.
- 4) The DVM should read -10dBu (+/-0.5dBu).
- 5) Return the FUNCTION switch to the IN position (process mode).

#### Remote Test:

- 1) Insert a 1/4" phone plug into the REMOTE JACK.
- 2) Confirm that the front panel function switch is inoperable. (The REMOTE footswitch will override the front panel switch.)
- 3) Switch the remote plug. Insure that the function changes from process to bypass.

#### LED Test:

- 1) Input a 5000Hz signal (@ -10dBu) into the connector marked CHANNEL A [B] INPUT. The green (+) led should light.
- 2) Input a 500Hz signal (@ -10dBu) into the connector marked CHANNEL A [B] INPUT. The red (-) led should light.
- 3) Disconnect the signal input and the amber (0) led should light
- 4) With the FUNCTION switched to the IN position the corresponding green LED should be lit.
- 5) With the FUNCTION switched to the OUT position the corresponding amber LED should be lit.

#### Clip Indicator Test:

- 1) Input a 500Hz signal with an amplitude of +16dBu (4.887Vrms) into the connector marked INPUT CHANNEL A [B]. Insure the corresponding CLIP LED is fully lit for each channel.

#### RCA Connector Test:

- 1) Switch the FUNCTION switch OUT (bypass mode).
- 2) Input a 500Hz signal (@ -10dBu) into the RCA connector marked CHANNEL A [B] INPUT.
- 3) Measure the RCA connector marked OUTPUT CHANNEL A [B] with the DVM set to AC volts.
- 4) The DVM should read -10dBu (+/-0.5dBu).
- 5) Return the FUNCTION switch to the IN position (process mode).

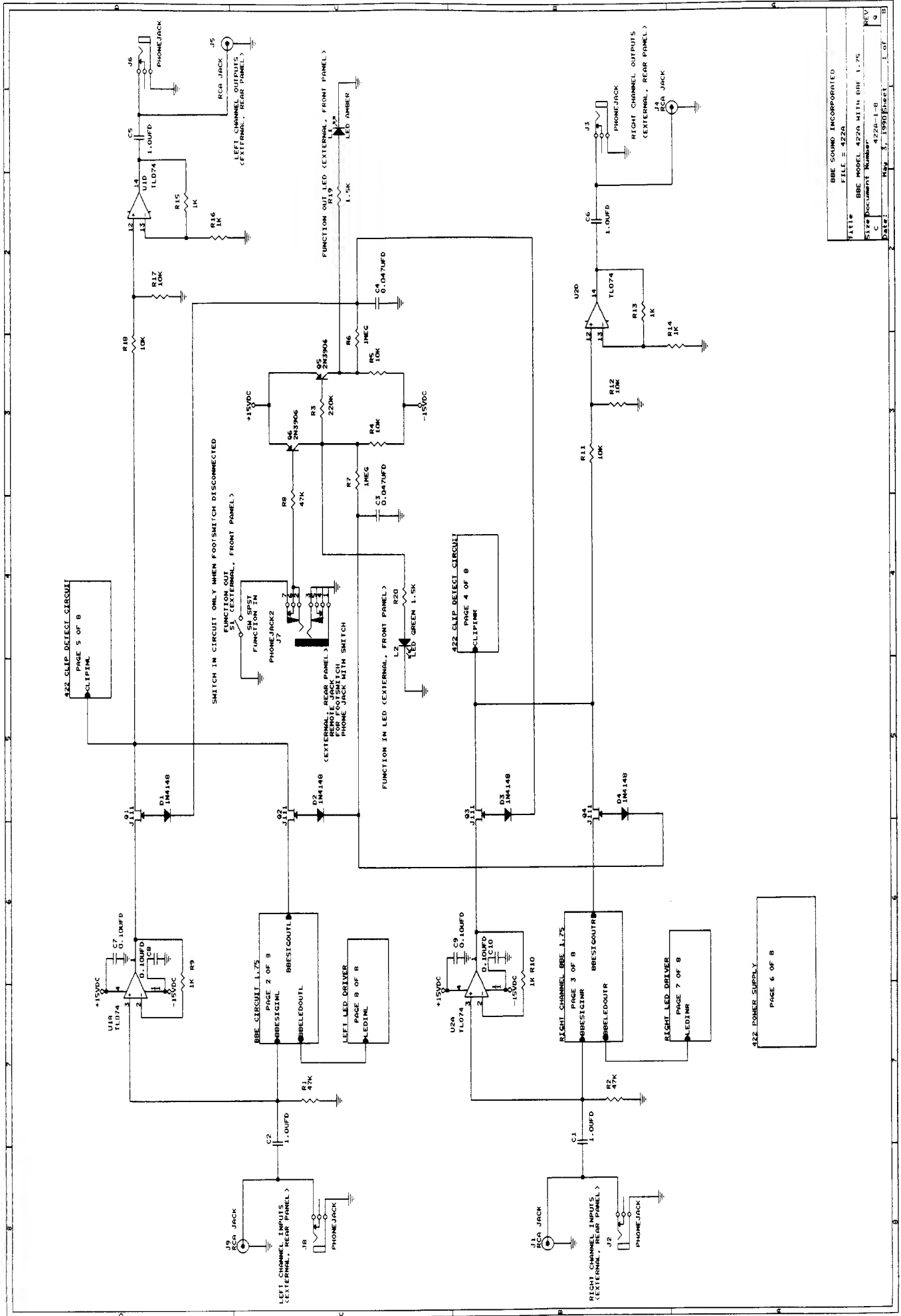
#### DC Voltage at Output Test:

- 1) Measure the output jacks to ground with the DVM set to DC volts the voltage must be less than 10mVDC.

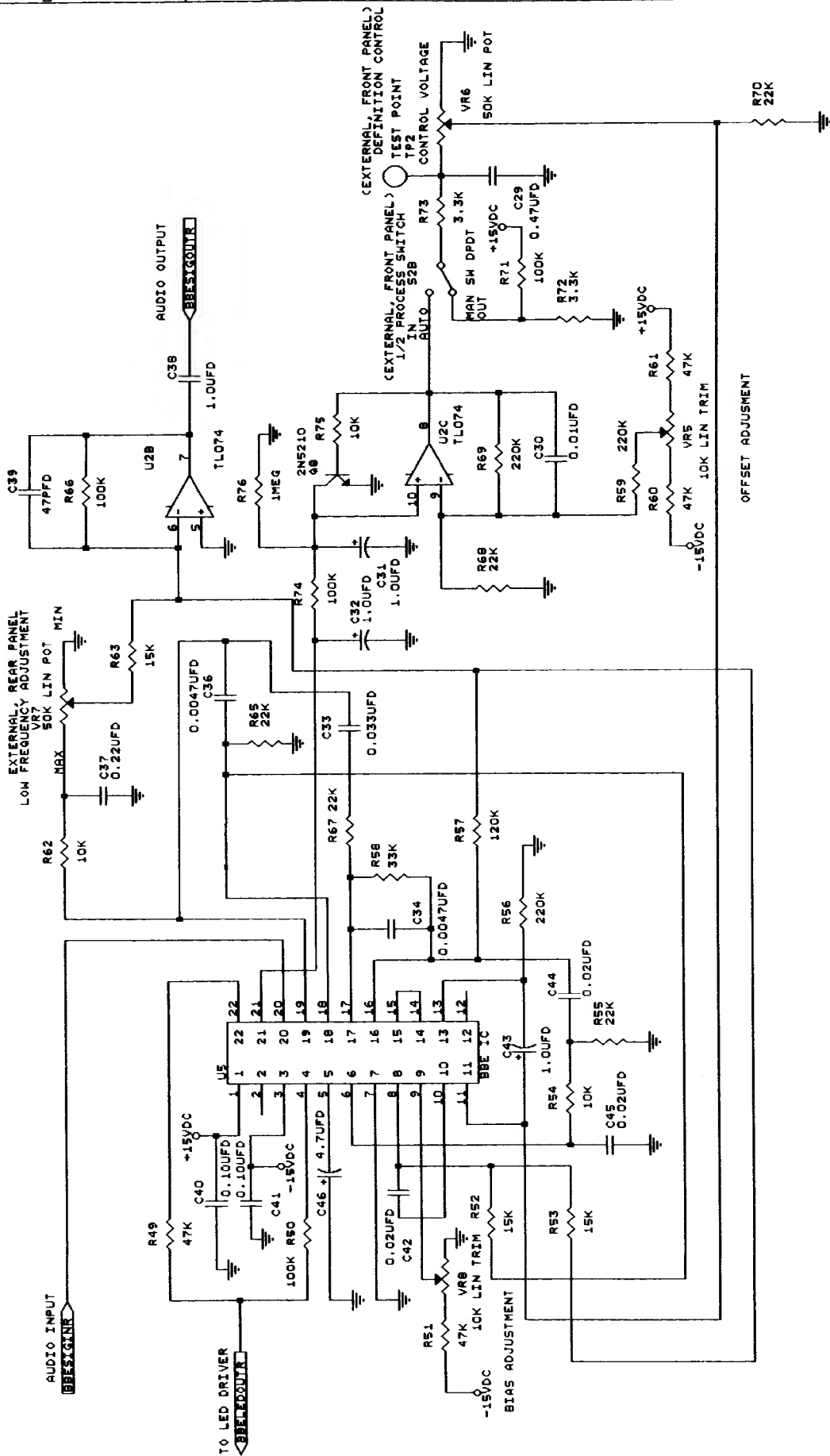
#### Offset drift test:

- 1) With no signal present at the input (open) measure TP1 [TP2] with the DVM set to DC volts.
- 2) Insure this voltage is 0.00VDC (+/- 25mVDC)

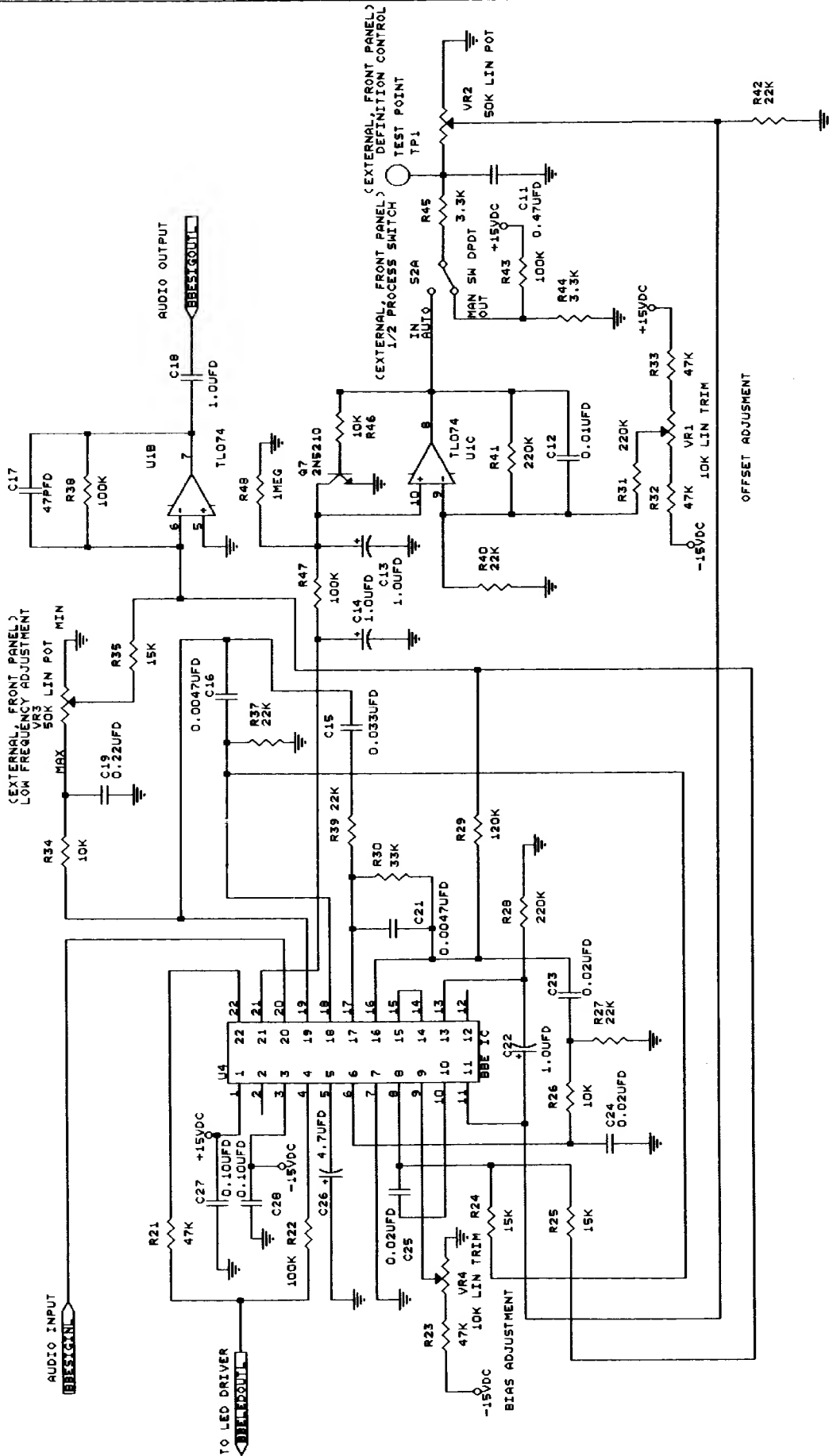
#### END TEST







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Size	Document Number
REV	A
Date	May 3, 1990
Sheet	3 of 8



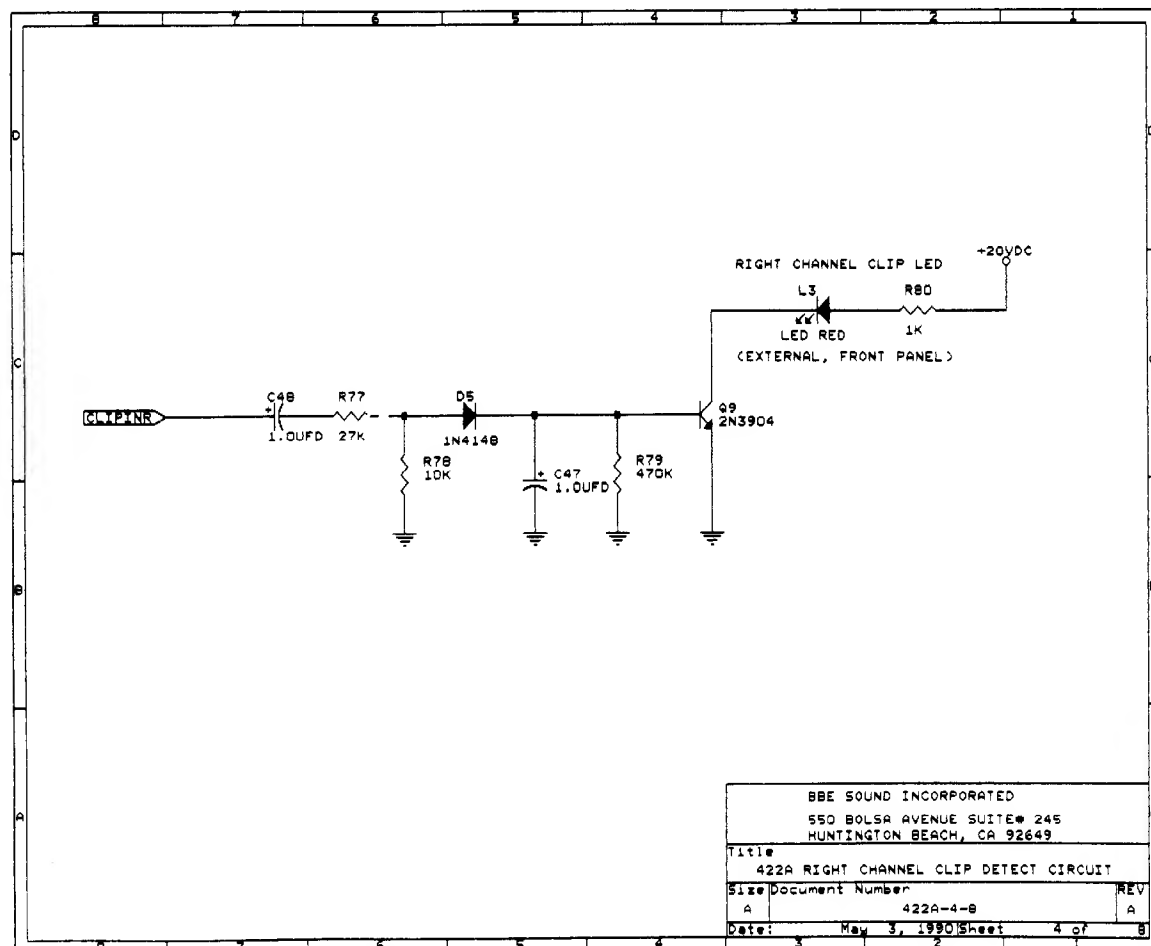
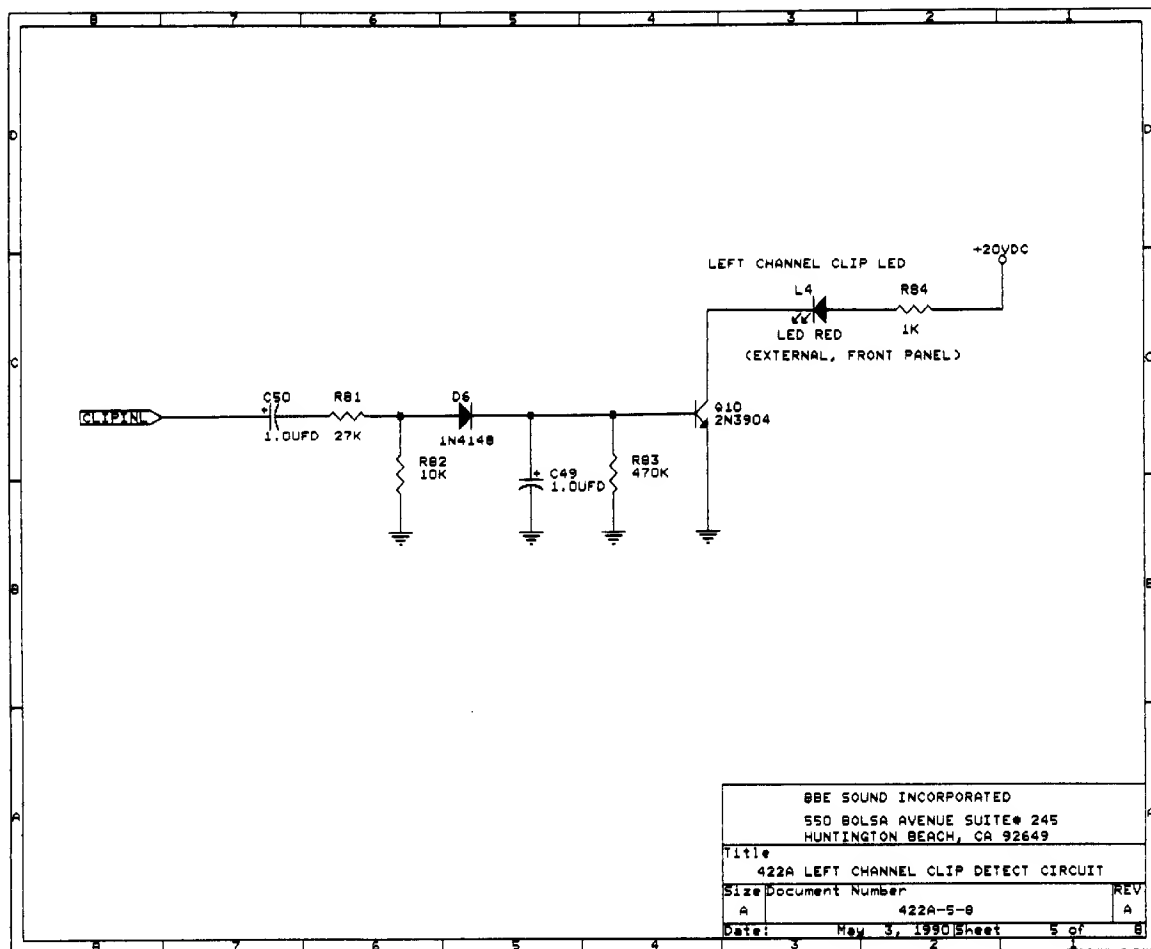
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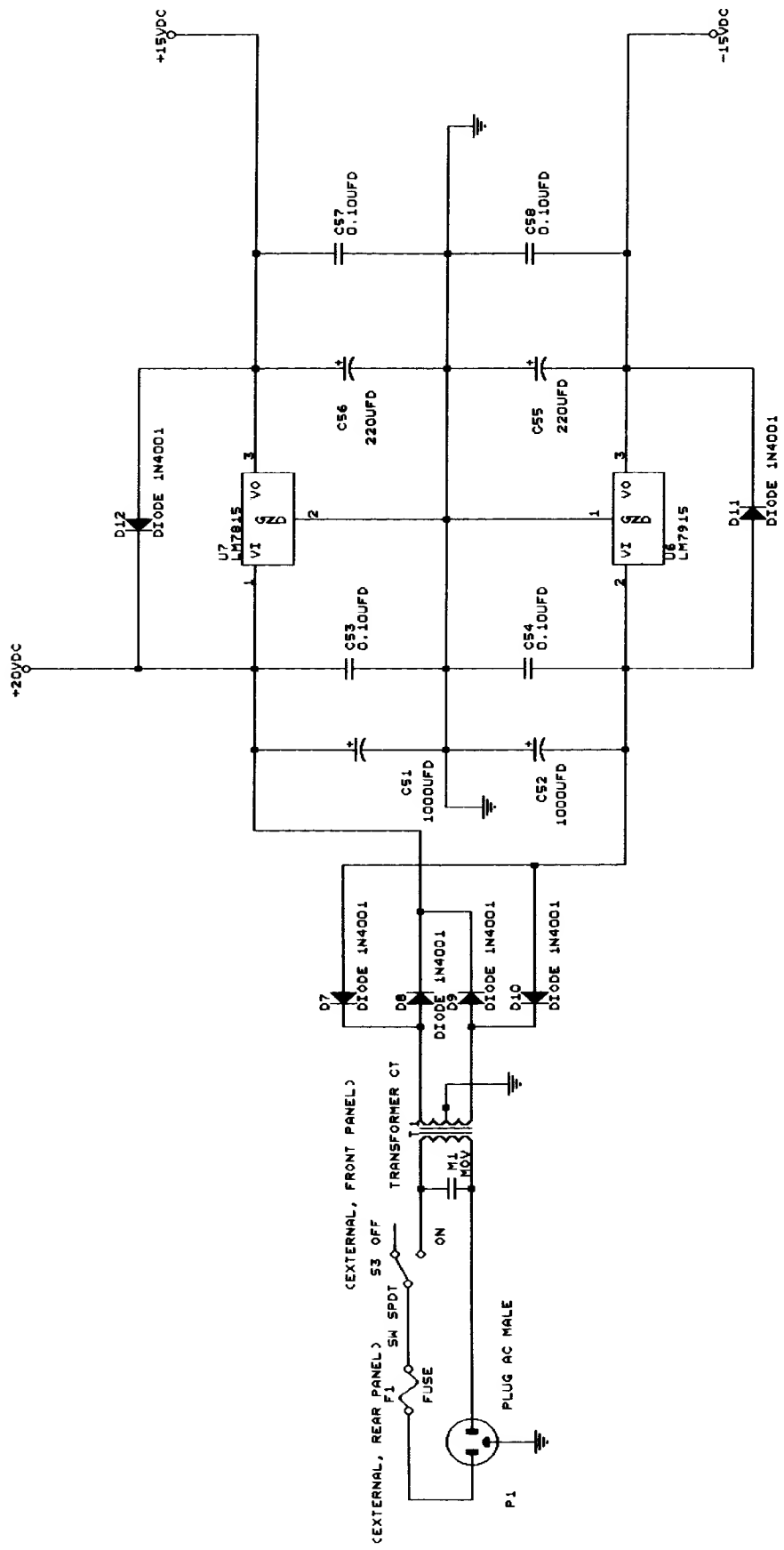
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Sheet	6 of 8

